least one circumferential projection, said cylinder assembly having at least one circumferential depression in which said projection is positioned to reciprocate, said projection and depression forming a pair of torroidal fluid working chambers of cyclically variable capacity, said component having at least one internal passage for movement of fluids to and from said working chambers and being linked mechanically to said scotch yoke, said crank assemblies being linked to at least one of said slots and are coaxial and contra rotatable.

Please add new claims 195, 196 and 197 as follows:

--195. *(New)* The device of claim 184, wherein said component is composed of elements of ceramic material held in assembled condition by at least one fastener loaded in tension. --

--196. *(New)* The device of claim 195, including means for conducting electricity in a designed circuit, said means being embedded within at least one of said elements. --

-- 197. *(New)* The device of claim 143, including means for conducting electricity in a designed circuit, said means being embedded in said ceramic material. --

REMARKS

Reexamination of this application and reconsideration of the rejection of the claims thereof are respectfully requested under the provisions of Rule 116 for the reasons set forth below.

Claims 81 and 102 have been called for filamentary material to be contained in said internal passage. Accompanying this amendment is a drawing marked in red to show filamentary material in the internal passage as well as a Letter to the Draftsman. Support for this correction to the drawings may be found on page 104, lines 1 to 3 and page 208, line 1.

Before discussion of the rejection of the claims is undertaken, the Examiner's attention is directed to certain claims under rejection which are also dependent directly or indirectly on allowed independent claims. Reference is made to claims 170, 171, 173, 174, 176 and 177 based directly or indirectly on one of claims 54, 55 and 107. It is submitted that the above indicated claims also should be considered as allowable.

Claims 61, 66-70, 75, 76, 78, 80, 83, 86, 84-92, 98, 99, 108 and 112-115 stand rejected under 35 USC 103(a) on Brown in view of Goldsborough because

> "Brown shows the toroidal working spaces defined by a piston and cylinder. However, the cylinder is made of metal. Goldsborough is merely cited as an example of the well known use of ceramic materials in engines so as to improve efficiency. The working element is coated with ceramic material and a fasteners 16 under tension are provided. Likewise, the cylinder has ceramic liners 20 assembled by fasteners (see 4 bolts mounted in a mirror image) under tension. To modify the piston and cylinder of Brown to be assembled with ceramic liners and consequently the necessary fasteners would have been obvious to one of ordinary skill in the art in view of Goldsborough so as to improve engine efficiency. In regard to claims 89-92, to use a piston/cylinder assembly in any of the recited power systems would have been obvious. In regard to claims 98 and 99,the depressions read on common manufacturing intolerances. A common spark plug reads on the electric circuit in the ceramic."

This rejection is respectfully traversed in view of the amendment. Brown makes no reference to the use of ceramic material as acknowledged by the Examiner. Goldsborough refers to an engine in which the piston extensions are provided with a lining of refractory material and the cylinder extensions are inherently of refractory material.

Goldsborough does not disclose or suggest a multiplicity of elements of ceramic material being held abutted with one another by a fastener loaded in tension. Goldsborough is dealing with modifying a conventional metal engine. Applicant, on the other hand, is claiming an uncooled ceramic engine. The concepts are entirely different and the teaching of one is not inherently the teaching of the other.

The present invention arose out of the idea to build an engine out of solid ceramic components. It was realized that for such to be commercially viable, the engine would have to have an entirely different configuration.

Present engines have evolved under three constraints: the materials characteristics of metals; the need for cooling (the water jacket, present block design); the most viable ways of manufacturing and assembling metal components. With uncooled ceramic engines all of these restraints become irrelevant and a new series of restraints would have to be imposed.

After consideration of the new parameters, the configurations of the disclosure were invented. These configurations are very different from those

present in commercial engines and pumps (see Figures 236, 237, 254, 255, 354 through 359, 408 through 411, 415 through 420, etc.)

It has not been possible to build engines of conventional design of integral ceramics as demonstrated by the failed efforts of the auto industry in the 1980's. Two small examples: the shape of the conventional poppet valve is appropriate for its metal construction. If built in ceramic, the sharp loads caused by the valve returning to its seat tend to cause the head to fracture and the bottom of the stem to separate from the head (due to tensile stresses caused by deceleration of the stem mass), since ceramics generally are less ductile and much weaker in tension relative to strength in compression. Today's engine blocks all have tapped screw threads, holding spark plugs, injectors, attachments, etc. It is not really practical to tap and screw into ceramics.

These constraints were part of the reasons why the present invention mostly eliminates poppet valves and shows new arrangements for assembling components. In fact, it seems that the only way to build uncooled ceramic engines is to press components against each by fasteners loaded in tension.

Claims 62, 63, 106, 126, 131, 141, 146, 151, 156 and 161 stand rejected under 35 USC 103(a) on Brown in view of Goldsborough as applied to claim 61 and further in view of U.S. Patent No. 3,112,810 to Nallinger because

> "It would have been obvious to located [sic] the engine of Brown in the noise deadening housing of Nallinger so as to reduce objectional noise levels. The foam material is deemed inherently thermally insulative."

This rejection is respectfully traversed in view of the amendment. Nallinger shows a housing around a conventional engine separated by an air space between. (A fan is shown dotted, implying a radiator and water cooling system.) For a conventional engine to function properly, at its designed temperature equilibria, a given amount of engine heat energy must be transferred from around the cylinder to the ambient air. In present engines this is achieved both by the cooling system and by general radiation of the hot engine block and other components. By enclosing the engine in a housing as shown by Nallinger, the heat transfer through general radiation is inhibited. For the engine to function as designed, the capacity of the cooling system must therefore be increased. Nallinger, by placing a housing spaced over the engine, is reducing the noise level, but at the same time lowering the capacity to remove heat from the engine in order to have the engine operate at its designed temperature equilibria. The applicant's claimed invention, on the other hand, is doing exactly the opposite, i.e. prevent the heat from escaping in order to have its engine operate at its designed temperature equilibria. Nallinger requires greater or additional cooling efforts to be made to maintain equilibria while putting a housing on his engine while applicant, by adding an insulated structure, eliminates or reduces the need for further heat to maintain equilibria since the engines of the present invention are designed to run uncooled.

An insulated structure as part of the engine only makes long-term commercial sense if the engine is designed from the outset to be an uncooled engine, as is the case in the present invention.

The air jacket shown in Nallinger is a relatively impractical insulation, since the single volume easily permits heat transfer by convection and adds much bulk to the engine assembly. In contrast, in the present invention, the structure is attached directly to the cylinder assembly.

Claims 82, 103, 118, 128, 133, 136, 138, 143, 148, 153, 158, 163, 166 and 168 stand rejected under 35 USC 103(a) on Brown in view of Goldsborough as applied to claims 75 and 106 above and further in view of U.S. Patent No. 3,503,716 to Burger because

> "Berger disclose the use of catalytic filamentary materials 23 for treating the exhaust of an engine and to apply its use toward the engine of Brown would have been obvious to one of ordinary skill in the art. The phrase 'at least partially surround' is broad enough to read on the catalyst being located anywhere."

In view of the amendment to claim 118, the rejection is respectfully traversed.

Berger does not show or teach a volume substantially within an engine or device which contains filamentary material.

It is not obvious to place filamentary material in exhaust processing volume within engine.

As the present and previous citations, all present exhaust treatments occur in a volume outside of and remote from the engine. Effective treatment depends

on the time the gases spend in the volume, which therefore needs to be as large as practical. Conventional engines have a short small exhaust port, typically of diameter equal to or less than valve head, beyond which the gases leave the engine and are conducted in pipes to a remote treatment volume. The volume of the exhaust port is too small to contain cost-effective treatment devices.

In the present invention, the engine components have been radically rearranged (in some sense they may be described as being turned "inside out") to enable a designer to create large fluid treatment volumes within the engine. Only if those large volumes are present is it commercially practical to introduce treatment methods including filamentary material within the engine.

In very general terms, the speed of chemical reactions increases roughly four times with a doubling of temperature. Because the disclosure relates to uncooled engines and other devices, an exhaust processing volume within the present engines could be at a temperature two to three times greater than that in the reactor of the citation, making such a volume potentially four to nine times more effective in the general treatment of exhaust-borne pollutants. The opportunity to locate relatively large exhaust treatment volumes within an engine is a significant advancement in the art of exhaust treatment. Again, we are dealing with a liquid cooled engine as versus an uncooled engine.

Claim 121 stands rejected under 35 USC 103(a) on Brown inview of Goldsborough and Berger as applied to claim 118 and further in view of Nallinger as applied above.

In view of the amendment to claim 118, the patent to Nallinger does not supply the lack of teaching of the three references applied.

Claim 123 stands rejected under 35 USC 103(a) on Brown in view of Goldsborough and Berger as applied to claim 118 and further in view of U.S. Patent No. 1,205,895 to Hoyt because Hoyt "shows the use of a scotch yoke and two oppositely rotating crankshafts to minimize vibration and to do likewise in Brown would have been obvious to one of ordinary skill in the art."

For reasons as stated above with respect to the rejection of claim 118, this rejection is respectfully traversed as Hoyt does not supply the lack of teaching of the three applied references.

Claims 184, 185, 192 and 193 stand rejected under 35 USC 103(a) on Brown in view of Hoyt as applied above.

This rejection is respectfully traversed inasmuch as Hoyt does not suggest or teach coaxial assemblies.

Claim 186 is rejected under 35 USC 103(a) on Brown in view of Hoyt as applied to claim 184 above and further in view of Nallinger as applied above.

This rejection is respectfully traversed for reasons as stated above with respect to the rejection of claim 184 and because Nallinger does not supply the lack of teaching of the other two references.

Claims 187-191 stand rejected under 35 USC 103(a) on Brown in view of Hoyt as applied to claim 184 above and further in view of Goldsborough as applied above.

This rejection is respectfully traversed for reasons as stated abovewith respect to the rejection of claim 184, since Goldsborough does not supply the lack of teaching of the other two references.

Claim 194 stands rejected under 35 USC 103(a) on Brown in view of Hoyt as applied to claim 184 above and further in view of Berger as applied above.

This rejection is respectfully traversed for reasons as stated above with respect to the rejection of claim 184 and because Berger does not supply the lack of teaching of the other two references.

In summation, claims 54, 55, 60, 107, 111, 116,117, 119, 120, 122, 124, 125, 127, 129, 130, 132, 134, 135, 137, 139, 140, 142, 144, 145, 147, 149, 150, 152, 154, 155, 157, 159, 160, 162, 164, 165, 167, 169, 172, 175, 179 and 181-183 stand allowed.

Claims 170, 171, 173, 174, 176 and 177 are deemed allowable since they directly or indirectly depend from an allowed claim.

Claims 61, 66, 67, 75, 106, 118, 121 and 184 have been amended and are now believed to be allowable.

Claims 68, 76 and 185 have been cancelled.

New claims 195, 196 and 197 have been added.

The remaining claims are dependent either directly or indirectly on the amended claims.

In view of the foregoing, early and favorable consideration is respectfully requested.

Respectfully submitted,

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